Extraction of Natural Dye Collected from Outer Skin of Onion and it's Application on Silk Fabric

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Abstract

Due to eco-friendliness of natural dyes and the awareness among people regarding the environmental and health hazards associated with the use of synthetic dyes, the craze for the clothing dyed with natural dye is increasing day by day. The aim of the work is to produce a variety of shades on the silk fabric by using Onion (Allium cepa) outer skin with different types of mordants such as Alum, Copper Sulfate, and Potassium Dichromate. Three different techniques of mordanting (Pre-mordanting, Meta-mordanting, and Postmordanting) have applied. The color fastness properties of dyed materials have also analyzed. After assessment of color fastness, it was found satisfactory in some cases and improved in many cases. As Onion is available and cheap, it will be convenient to produce unique shades of silk fabric, and to produce trendy and fashionable garments.

Index terms— natural dye, allium cepa, extraction, mordanting, silk, color fastness.

1 Introduction

owadays, the Environment pollution is emerging as an alarming issue all over the world. The textile industry regards as the most polluting, as water pollution caused by effluents. These effluents contain toxic chemicals like carcinogenic amines and mutagens in Azo dyes, heavy metals, formaldehyde, etc. [1] Environmentalists are always concerned about the unbridled use of synthetic dyes in the textile industry as they cause water pollution and different problems related to waste disposal. [2] In recent times, due to lower price and a wide range of bright shades with improved color fastness properties, synthetic dyes have been widely used as compared to natural dyes [3][4].

Natural dyes are experiencing a new beginning in the field textile coloration. They are more compatible with the environment compared to synthetic dyes because they are eco-friendly, non-toxic, non-allergenic and biodegradable. [5] Natural dyes are colorants obtained from different natural sources without any synthesizing. It includes all the dyes derived from different natural sources such as plants, animals, and minerals. There are different types of natural dyes like henna, onion, turmeric, marigold, betel nut, etc. The roots, stems, barks, leaves, berries, and flowers of various dye plants are continuously using for dyeing carpets, rugs, and clothing. Due to no substantivity of most of the natural dyes, it has to apply to the substrate with the help of different mordants. [6] Even though Synthetic dyes have many benefits, it has one negative side which deluges all the benefits, and the negative side is that it is not compatible with our environment. It is the high time to reconsider the use of natural dyes. [7] In this regards, many commercial dyers already have started using natural dyes as a convenient replacement of synthetic dyes to overcome the environmental damage caused by synthetic dyes. Also, synthetic dyes such as azo dyes are found to be carcinogenic. [8] Natural dyes are capable of producing unique, uncommon, alleviating and soft shades as compared to synthetic dyes as well Onion (Allium cepa) is a vegetable used in our daily life for cooking food and widely cultivated around the world. Most onions cultivated contain about 89% water, 4% sugar, 1% protein, 2% fiber. Onion also contains different types of Vitamins like Vitamin B1, Vitamin B2, Vitamin B3, and Vitamin C; it also contains compounds such as phenolics and flavonoids as well

as elements like iron, calcium, magnesium, manganese, and zinc. [9] The skin of onion is not edible and considered as wastage. However, it contains a coloring pigment called "Pelargonidin" (3, 5, 7, 4 tetrahydroxyantocy anidol). The amount of this coloring pigment is found to be 2.25%, and the structural formula of it has shown in Onion is cultivated all over the country but extensively cultivated in Faridpur, Dhaka, Rajshahi, Comilla, Jessore, Dinajpur, Mymensingh, Rangpur, and Pabna in Bangladesh. Onion has become an integral part of the people's daily diet, and its use is very typical in almost all food preparations in Bangladesh. Onion mainly uses as a spice in Bangladesh. The only edible portion of onion is the bulb whereas Onion skin is inedible. [11] II.

2 Materials and Method a) Colorant and Substrate

Waste outer skin of Onion (Allium cepa) was brought from the local market and washed with water and then dried at room temperature. After that, the skin had meshed and extracted the color by heating with water at 60 degree Celsius temperature for one hour. Degummed silk fabric had used as a substrate for dyeing.

3 b) Chemicals and Machine

As chemicals Alum, Potassium dichromate, and Copper sulfate of different concentrations, and as the machine the conventional sample (lab) dyeing machine had used for dyeing in this research.

4 c) Fastness properties

According to the ISO 105 C03 test method washing fastness of the dyed sample was done. The assessment of color fastness to rubbing was done by following ISO 105:12 test method.

5 d) Extraction Process of Onion

Extraction is usually used to recover a component either from a solid or liquid. The outer skin of onion can be extracted with water by heating. The collected outer skin of onion mixed with water, and heated for 60 minutes at 65 °C (degree Celsius) temperature. Finally, the liquid dye from the skin was separated by filtration. The process was repeated for the same solid material to extract the dye portion as much as possible. The extraction process curve of onion has shown in Figure -2. A mordant is a dye fixative and able to use for dyeing fabrics with natural dyes. The natural dyes have no substantivity to the substrate. Three types of mordanting techniques named pre-mordanting, metamordanting, and post-mordanting commonly used for the coloration of textile substrate with natural dyes. In pre-mordanting the substrate is treated with the mordant, and then dyed, in meta-mordanting, the mordant is added to the dye bath itself, and in postmordanting, the dyed material is treated with the mordant.

In this experiment three types of mordants used with the different concentration of mordants and pre, meta, and post-mordanting techniques had applied. In this experiment, 1% to 3% mordant used in all pre, meta and post-mordanting techniques.

6 f) Degumming of Silk Fabric

Silk fiber contains natural impurities called gum or sericin. This sericin is near about 20% of weight compared to the whole weight of Silk fiber. Besides this Silk fiber comprises some wax and natural colors. In this work, degumming had used to remove these materials by treating the substrate with soda ash.

Raw Silk fabric was degummed in according to the following recipe which is shown in Table-1, and the degummed fabric was washed with 2 g/l detergent at 65°C for 10 minutes. Also, the process curve for degumming of silk fabric has been shown in figure -3. For meta and post-mordanting the dyeing process was the same, but the mordant used in dye bath during dyeing for meta-mordanting, and after dyeing for post-mordanting. The recipe for dyeing of silk fabric with onion skin has shown in table-2. Also the process curve for dyeing of silk fabric with onion skin has represented in figure -4. In this research, a variety shades of silk fabric produced by using the outer onion skin, shown in Table **??**3. Besides, it also found that for getting excellent shade, it must need to use different types of mordants. In this experiment, it has been tried to show that how different techniques of mordanting change the shades despite using the same mordant with the same concentration. Table-6 shows color fastness to rubbing was very good for all the samples but color fastness to washing was not good for all that has shown in Table **??**

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Figure 1: Figure- 1 . [10]Figure 1 :

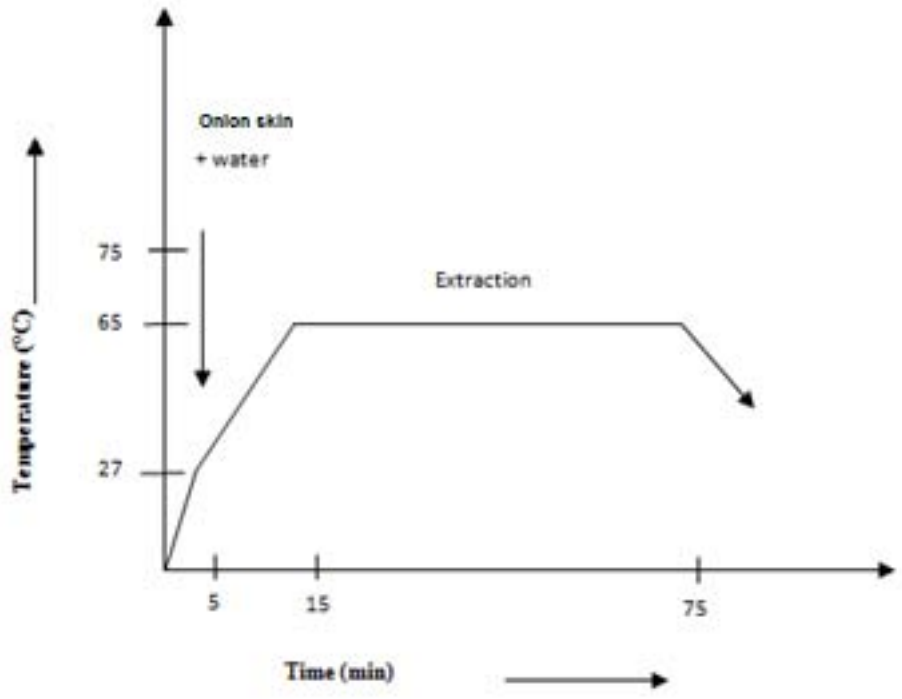

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Figure 2: Figure 2 :

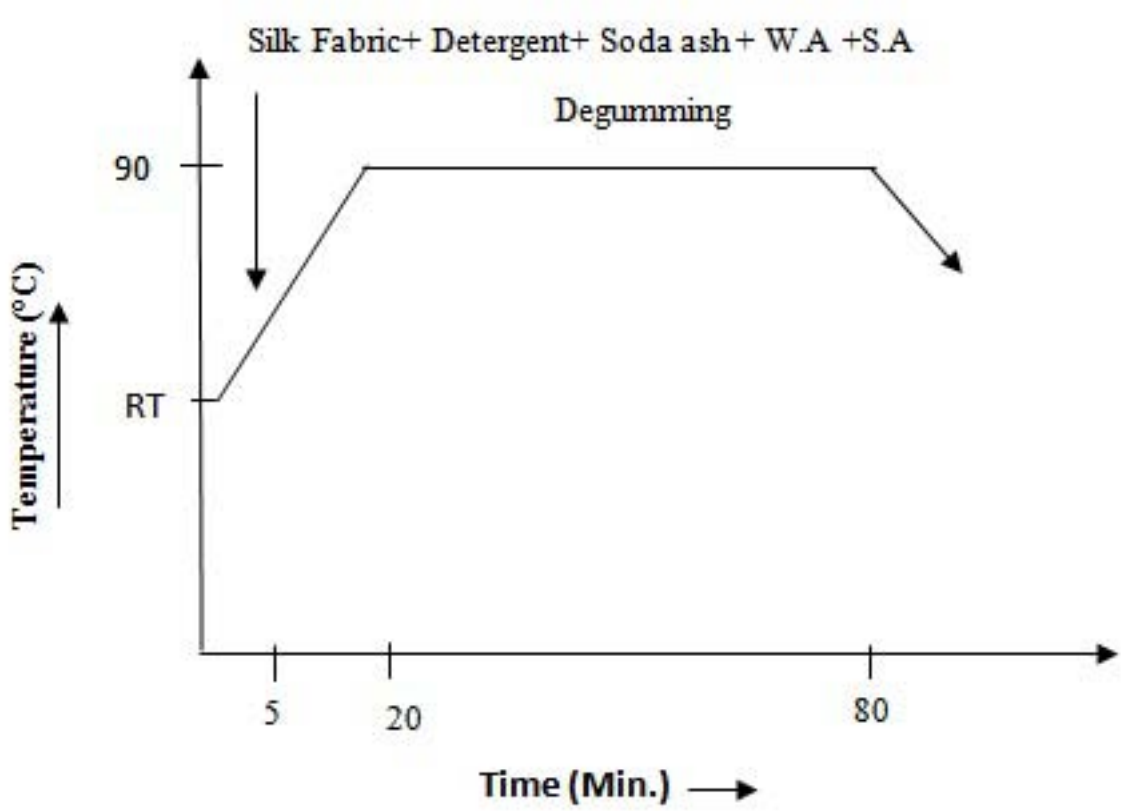

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Figure 3: Figure 3 :

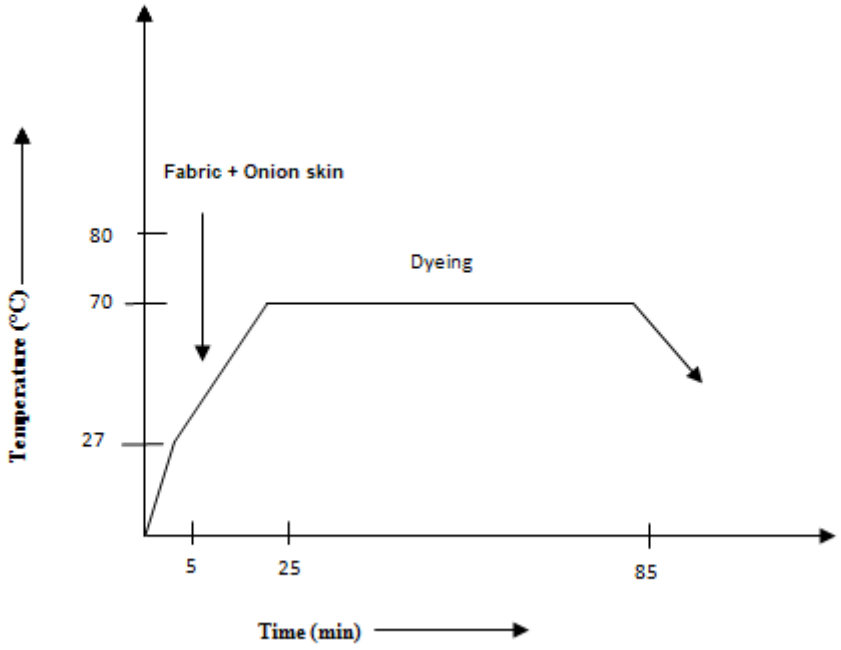

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Figure 4: GlobalFigure 4 :

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Year 2018
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Figure 5: Table 1 :

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Figure 6: Table 2 :

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	Mordants	Conc. (%)	Pre-mordanted	Meta-mordanted	Post-mordanted
	Alum	1			
Year 2018	Alum	2			
4					
( ) Volume XVIII Issue III Version	Alum K 2 Cr 2 O 7 K 2	3 1 2 3			
I J	Cr 2 O 7 K 2 Cr 2 O 7				
Global Journal of Researches in Engineering	CuSO 4 CuSO 4 CuSO 4	1 2 3			
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Figure 7: Table 3 :

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Sl. No.	Mordants	Pre-mordant	Meta-mordant	Post-mordant
1	Alum 1%	2	1	2
2	Alum 2%	3	2	2
3	Alum 3 %	4	3	3
4	CuSO 4 1%	2	1	2
5	CuSO 4 2%	3	2	3
6	CuSO 4 3%	4	3	3
7	K 2 Cr 2 O 7 1%	3	3	3
8	K 2 Cr 2 O 7 2%	3	4	4
9	K 2 Cr 2 O 7 3%	2	4	4

Figure 8: Table 4 :

5

Sl. No.	Mordants	Pre-mordant	Meta-mordant	Post-mordant
1	Alum 1%	4-5	4-5	4-5
2	Alum 2%	4-5	4-5	4-5
3	Alum 3 %	4-5	4-5	4-5
4	CuSO 4 1%	4-5	4-5	4-5
5	CuSO 4 2%	4-5	4-5	4-5
6	CuSO 4 3%	4-5	4-5	4-5
7	K 2 Cr 2 O 7 1%	4-5	4-5	4-5
8	K 2 Cr 2 O 7 2%	4-5	4-5	4-5
9	K 2 Cr 2 O 7 3%	4-5	4-5	4-5
c) Color fastness to rubbing				

Figure 9: Table 5 :

6

Sl. No.	Mordants	Dry/Wet	Pre-mordant	Meta-mordant	Post-mordant
1	Alum 1%	Dry Wet	4-5 4	4-5 4	4-5 4
2	Alum 2%	Dry Wet	4-5 4	4-5 4	4-5 4
3	Alum 3 %	Dry Wet	4-5 4	4-5 4	4-5 4
4	CuSO 4 1%	Dry Wet	4-5 4	4-5 4	4-5 4
5	CuSO 4 2%	Dry Wet	4-5 4	4-5 4	4-5 4
6	CuSO 4 3%	Dry Wet	4-5 4	4-5 4	4-5 4
7	K 2 Cr 2 O 7 1%	Dry Wet	4-5 4	4-5 4	4-5 4
8	K 2 Cr 2 O 7 2%	Dry Wet	4-5 4	4-5 4	4-5 4
9	K 2 Cr 2 O 7 3%	Dry Wet	4-5 4	4-5 4	4-5 4

Figure 10: Table 6 :

Figure 11:

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